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EXAMINER

ZHENG, LOIS L

ART UNIT	PAPER NUMBER
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1742

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/731,331	Applicant(s) TSAO ET AL.	
	Examiner Lois Zheng	Art Unit 1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 23-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 23-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status of Claims

1. Claims 1-12 are amended in view of applicant's amendment filed 2 April 2007. Claims 13-22 are canceled in view of applicant's amendment. New claims 23-30 are added in view of applicant's amendment. Therefore, claims 1-12 and 23-30 are currently under examination.

Specification

2. Applicant's amendment to specification filed 2 April 2007 is entered.

Drawings

3. The drawings were received on 2 April 2007. These drawings are acceptable.

Previous Rejections/Objections

4. The objections to Figures 3-4 are withdrawn in view of applicant's replacement drawing and amendment to specification filed 2 April 2007.

The rejection of claim 6 under 35 U.S.C. 112, second paragraph, is withdrawn in view of applicant's claim amendment filed 2 April 2007.

The rejection of claims 1-4 and 7-10 under 35 U.S.C. 102(b) as being anticipated by Lakshmikanthan et al. US 6,228,233 B1(Lakshmikanthan) is withdrawn in view of applicant's claim amendment filed 2 April 2007.

The rejection of claims 5-6 and 11-12 under 35 U.S.C. 103(a) as being unpatentable over Lakshmikanthan in view of Dordi et al. US 6,416,647 B1(Dordi) is withdrawn in view of applicant's claim amendment filed 2 April 2007.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-4, 7-10, 23-24, 26-27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshmikanthan et al. US 6,228,233 B1(Lakshmikanthan) in view of Oberlitner et al. US 6,547,937 B1(Oberlitner).

Lakshmikanthan teaches an electroplating cell comprising a bath container, an anode immersed in an electrolyte bath in the bath container, a current source connecting to the anode and to a contact ring electrically connecting to the front side of the substrate(Fig. 2 #102, 108, 122 and 114).

Regarding claims 1 and 7, Lakshmikanthan further teaches that its electroplating cell comprises a variable pressure application system. The variable pressure application system as taught by Lakshmikanthan comprises a mounting plate, a bladder assembly located at the edge region of the mounting plate and a pressure/vacuum pumping system located at the center region of the mounting plate(Fig. 2 # 132, Fig. 2A # 130 and Fig. 2 # 159). The bladder assembly, connected to a pressure source(Fig. 2 #138), when inflated pushes the wafer against the contact ring, which is located at the peripheral region of the wafer, to position the wafer and establishing the electrical connection to the wafer(col. 6 line 41 – col. 7 line 8). The pressure/vacuum pumping system, connected to a separate pressure source(Fig. 2 # 145), applies pressure to the

backside of the wafer to create a bowing effect that results in superior deposition(col. 7 lines 42-55). Since the pressure from the bladder system and the pressure/vacuum pumping system as taught by Lakshmikanthan can be separately controlled(col. 6 line 66 – col. 7 line 3, col. 7 lines 46-50), the examiner concludes that the variable pressure application system of Lakshmikanthan is capable of asserting a lower peripheral pressure and a higher central pressure on the wafer as claimed.

However, the contacting ring as taught by Lakshmikanthan is located on the plating surface of the substrate instead of the non-plating surface of the substrate as claimed.

Oberlitner teaches an electroplating apparatus wherein an electrical contact ring engages the backside or the non-plating side of the substrate(Fig. 27 #174, 198) and a backside pressure is applied against the substrate(col. 16 line 60 – col. 17 line 7). Oberlitner further teaches that one skilled in the art would have easily incorporated a front side contact instead of a backside contact(col. 17 lines 117-20).

Therefore, Oberlitner's teaching indicates that both front side contact and backside contact are functionally equivalent techniques well known in the electroplating art. It would have been obvious to one of ordinary skill in the art to have substituted the front side contact ring as taught by Lakshmikanthan with the backside contact ring as taught by Oberlitner with expected success since they are perform the same function of providing electrical current to the substrate.

Regarding claims 1 and 7, the variable pressure application system as taught by Lakshmikanthan in view of Oberlitner is capable of engaging the backside contact ring

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and apply variable pressure to the central and peripheral regions of the substrate backside as claimed.

Regarding claims 2 and 8, the mounting plate as taught by Lakshmikanthan reads on the claimed thrust pad.

Regarding claim 26, the instant claim is mostly rejected for the same reasons as stated in the rejection of claims 1-2 and 7-8 above. In addition, the electroplating apparatus of Lakshmikanthan in view of Oberlitner is capable of plating metal on the front side center region of the substrate as claimed.

Regarding claims 3, 9 and 27, Lakshmikanthan further teaches that the gas supply used for inflating the bladder assembly can be air(col. 6 liens 46-48). The examiner believes that using air as gas supply for the pressure/vacuum pumping system is also within the scope of Lakshmikanthan in view of Oberlitner. Therefore, the gas supply for the bladder system of Lakshmikanthan in view of Oberlitner reads on the claimed peripheral air source and the gas supply for the pressure/vacuum pumping system of Lakshmikanthan in view of Oberlitner reads on the claimed central air source.

Regarding claims 4 and 10, the mounting pad as taught by Lakshmikanthan is capable of engaging the variable pressure application and the contacting for transmitting a central pressure and a peripheral pressure as claimed.

Regarding claims 23-24 and 29, the claimed central and peripheral pressure are directed to the operating pressure for the claimed apparatus, therefore, are process limitations. As stated in MPEP 2114 [R-1], it is well settled that the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed

apparatus from a prior art apparatus as long as the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). Therefore, these pressure limitations do not lend patentability to the instant claim since they are process limitations and provide no additional structural limitations to distinguish the claimed apparatus from the prior art.

7. Claims 5-6, 11-12, 25, 28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshmikanthan in view of Oberlitner, and further in view of Dordi et al. US 6,416,647 B1(Dordi).

The teachings of Lakshmikanthan in view of Oberlitner are discussed in paragraph 6 above. Lakshmikanthan further teaches that its bladder system comprises a plurality of inlet ports provide gas supply to inflate the bladder system(col. 5 lines 15-23, col. 5 line 66 – col. 6 line 2). Therefore, the plurality of inlet ports in the bladder system as taught by Lakshmikanthan reads on the claimed plurality of peripheral air openings.

However, Lakshmikanthan in view of Oberlitner do not explicitly teach the claimed plurality of central air openings.

Dordi teaches an electroplating apparatus comprising plurality of openings on the wafer supporting surface for blowing gas flow to the backside of the wafer in order to prevent backside contamination(abstract).

Regarding claims 5, 11 and 28, it would have been obvious to one of ordinary skill in the art to have incorporated the plurality of openings as taught by Dordi into the pressure/vacuum pumping system of Lakshmikanthan in view of Oberlitner in order to

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prevent backside contamination as taught by Dordi. Therefore, the plurality of openings in the pressure/vacuum pumping system of Lakshmikanthan in view of Oberlitner and Dordi meets the limitation of the claimed plurality of central air openings. The mounting plate as taught by Lakshmikanthan in view of Oberlitner and Dordi reads on the claimed platen.

Regarding claims 6, the mounting plate as taught by Lakshmikanthan in view of Oberlitner and Dordi reads on the claimed platen to engage the backside contact ring and to transmit a center pressure and a peripheral pressure as recited in instant claim 6.

Regarding claim 12, the instant claim is rejected for the same reasons as stated in the rejection of claim 10 above.

Regarding claims 25 and 30, Lakshmikanthan further teaches that the anode provides metal source for the electrolyte(col. 4 lines 43-45), which implies that the anode is a consumable anode that comprises the metal to be electroplated. However, Lakshmikanthan does not explicitly teach that the anode comprises copper.

Dordi teaches electroplating copper onto semiconductor substrate using a consumable anode(col. 2 lines 3-31 and abstract).

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated a consumable anode comprising copper as taught by Dordi into the apparatus of Lakshmikanthan in view of Oberlitner since Dordi teaches that copper is a desirable metal for the interconnect features on semiconductor substrates(col. 2 lines 9-11).

Response to Arguments

8. Applicant's arguments filed 2 April 2007 have been fully considered but they are partially moot in view of the new grounds of rejection set forth above.

Applicant further argues that the combination of Lakshmikanthan with Dordi would make the apparatus of Lakshmikanthan unsuitable for its intended purpose.

The examiner does not find applicant's argument persuasive since the multiple vacuum ports as taught by Dordi is also used to provide blow-off gas to prevent backside contamination. Therefore, these ports as taught by Dordi are capable of providing variable pressure to the backside of the substrate(i.e. negative pressure when vacuum is applied and positive pressure when blow-off gas is applied). Since the backside pressure supply system as taught by Lakshmikanthan can also supply both pressure and vacuum(col. 5 lines 51-56), the incorporation of multiple ports as taught by Dordi into the apparatus of Lakshmikanthan would not have changed the operations of Lakshmikanthan's apparatus and make it unsuitable for its intended purpose.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Padhi et al. US 2004/0118699 A1 teaches using a contact ring engaging the backside of the wafer(Fig. 2 # 266), but also uses a vacuum chuck to position the wafer substrate.

Lubomirsky et al. US 2004/0055893 A1 teaches using a plurality of contact pins engaging the backside of the wafer wherein these contact pins can be electrically

controlled individually or in groups, but also uses a vacuum chuck to position the wafer substrate.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lois Zheng whose telephone number is (571) 272-1248. The examiner can normally be reached on 8:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

LLZ


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